In the Claims

1. (Original) A method of identifying load and motor fault information in a condition monitoring system comprising the steps of:

simultaneously sampling voltage and current data of an induction machine in operation;

determining an indicator of reactive power from a portion of the sampled voltage and current data; and

determining an internal motor fault using the indicator of reactive power.

2. (Original) The method of claim 1 further comprising the steps of determining an indicator of real power from another portion of the sampled voltage and current data and determining a load fault from the indicator of real power.

3. (Original) The method of claim 2 further comprising the step of determining a frequency spectrum of real power and a frequency spectrum of reactive power.

4. (Original) The method of claim 3 further comprising the steps of analyzing the frequency spectrum of reactive power to determine a motor fault and analyzing the frequency spectrum of the indicator of real power to determine a load fault.

5. (Original) The method of claim 4 wherein the load fault includes a motor driven fault.

6. (Original) The method of claim 1 further comprising the steps of:

determining two-phase voltages and two-phase current values from the sampled voltage and current data;

determining a reference frame transformation angle from the two-phase voltage values; and

transforming the two-phase current values and the two-phase voltage values to a rotating reference.

7. (Original) The method of claim 1 wherein the reactive power is an instantaneous reactive power.

8. (Original) An induction motor monitoring system comprising:

at least one voltage sensor and at lease one current sensor; and

a controller connected to the at least one voltage and the at least one current sensors and configured to:

receive voltage and current data from the at least one voltage and the at least one current sensor;

determine instantaneous reactive power from the voltage and current data;

generate a frequency spectrum of the instantaneous reactive power; and

determine a motor fault from at least the frequency spectrum.

9. (Original) The system of claim 8 wherein the at least one voltage sensor includes a pair of voltage sensors configured to acquire line-line voltages of two phases of an induction motor and wherein the at least one current sensor includes a pair of current sensors configured to acquire line-line currents of the two phases of the induction motor and wherein the controller is further configured to determine two-phase voltage and two-phase current values from the voltage and current data.

10. (Original) The system of claim 9 wherein the controller is further configured to determine a reference frame transformation angle and apply a reference frame transform to transform the two-phase voltage and the two-phase current values to a rotating reference using the reference frame transformation angle.

11. (Original) The system of claim 10 wherein the controller is further configured to determine the instantaneous reactive power from the transformed two-phase voltage and the transformed two-phase current values.

12. (Original) The system of claim 11 wherein the controller is further configured to determine an instantaneous real power value from the transformed two-phase voltage and the transformed two-phase current values.

13. (Original) An apparatus to distinguish betwe n a motor fault and a load fault in an AC induction motor, the apparatus comprising:

at least two current sensors for obtaining at least two AC motor current signals;

at least two voltage sensors for obtaining at least two AC motor voltage signals;

an analog-to-digital converter for converting the at least two AC motor current signals to digitized current signals and the at least two AC motor voltage signals to digitized voltage signals; and

a microprocessor to receive the digitized signals and compare instantaneous reactive power values to a set of baseline reactive power values to determine a motor fault in the motor.

14. (Original) The apparatus of claim 13 wherein the microprocessor computes a frequency spectrum of the instantaneous reactive power values and compares the frequency spectrum to a baseline reactive power frequency spectrum to determine the motor fault.

15. (Original) The apparatus of claim 13 wherein the microprocessor applies a reference frame transformation to the digitized signals prior to calculating the instantaneous reactive power values.

16. (Original) The apparatus of claim 13 wherein the processor calculates instantaneous real power values from the digitized signals and compares the instantaneous real power values to a set of baseline real power values to determine a motor-driven fault in the AC motor.

17. (Original) The apparatus of claim 16 wherein the processor computes a frequency spectrum of the instantaneous real power values and compares the frequency spectrum to a baseline real power frequency spectrum to determine the motor driven fault.

18. (Original) A computer readable storage medium having a computer program stored thereon to determine faults in an AC induction motor and representing a set of instructions that when executed by a computer causes the computer to:

model operation of an AC motor having a load thereon and known to be operating normally and determine baseline operation therefrom;

acquire real-time voltage and real-time current data of the AC motor in operation;

determine reactive power of the AC motor from the real time voltage and real-time current data;

compare the reactive power to the baseline operation; and

determine presence of fault conditions in the AC motor from at least the comparison.

19. (Original) The computer readable storage medium of claim 18 wherein the set of instructions further causes the computer to issue a warning if a fault condition is found to be present in the AC motor.

20. (Original) The computer readable storage medium of claim 18 wherein the set of instructions further causes the computer to apply a reference frame transform to the real-time voltage and real-time current data.

21. (Original) The computer readable storage medium of claim 18 wherein the set of instructions further causes the computer to generate a frequency spectrum of the reactive power and display the frequency spectrum on a console for visual analysis by a user.

22. (Original) The computer readable storage medium of claim 21 wherein the set of instructions further causes the computer to display the frequency spectrum of the reactive power relative to a frequency spectrum of the baseline operation to visually indicate a fault condition in the AC motor.

23. (Original) A motor fault detector for an AC induction motor, the detector comprising:

means for acquiring voltage and current data of an AC motor in operation;

means for determining instantaneous reactive power in the AC motor from the voltage and current data; and

means for determining an internal fault in the AC motor from the instantaneous reactive power.